US-PAT-NO: 3905805

DOCUMENT-IDENTIFIER: US 3905805 A

TITLE: Recycling of ferromanganese precipitator dusts

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Brief Summary Text - BSTX (9):

In a preferred practice of our invention, alkali is extracted from the moist dust-cake by mixing the cake with coke-plant flushing-liquor water, and the remaining manganese-bearing solids are subsequently recovered. Although pre-dried cake is extracted equally well, the utilization of moist as-received cake is more practical in consideration of the nature of the process and the cost of drying facilities. Similarly, the flushing liquor is used in an as-received condition; however, it may sometimes be preferable to clarify the liquor to remove suspended tar particles. The mixing of the dust-cake and liquor may be accomplished by any device capable of disintegrating the dust-cake and dispersing the resultant particles within the liquor. Mixing time can be from 10 to 180 minutes; however, a more practical upper limit is 60 minutes, and we prefer to operate at a mixing time of about 15 minutes. During the extraction, the temperature may be maintained from 0.degree. to 100.degree.C, and a likely temperature range for commercial operations is 25.degree. to 75.degree.C. We prefer a temperature of about 50.degree.C. Following the extraction, the beneficiated solids may be recovered by centrifugation, filtration, or decantation.

US-PAT-NO: 4201748

DOCUMENT-IDENTIFIER: US 4201748 A

TITLE: Process for thermal-activation of chalcopyrite-pyrite concentrates

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Detailed Description Text - DETX (21):
The acid leachable sulfide concentrate or calcine is subjected to an acid leach in aqueous sulfuric acid to produce a solution of ferrous sulfate and a beneficiated solids residue containing copper sulfides, which are amenable to recovery of copper, and residual iron with concurrent evolution of H.sub.2 S gas.

Detailed Description Text - DETX (30):
The solids fraction containing beneficiated solids residue containing copper sulfides and residual iron can be treated by an oxidation leach as described in U.S. Pat. No. 3,964,901 in an integrated process for production of elemental sulfur and copper sulfate solution which is suitable for recovery of high purity copper by electrowinning or hydrogen reduction. Precious metals and zinc and other non-ferrous metals can be recovered separately.

Detailed Description Text - DETX (31):
Alternatively, the thermal activation of pyritic copper sulfides, acid leaching and iron removal can be operated as an independent process to upgrade
poor primary concentrates at a mine site for shipping of the improved concentrate, i.e. beneficiated solids residue from the acid leach, to an existing smelter. This would yield an overall higher copper recovery from ore to metal, reduction in freight charges, savings in smelting costs and improved environmental control. Concentrates from such upgrading could, for example, be
treated by simplified smelting methods such as converting in an oxygen lanced top blown rotary converter followed by electrorefining.

Claims Text - CLTX (4):

4. A process as claimed in claim 3, in which the acid leachable sulfide concentrate is subjected to an acid leach in aqueous sulfuric acid to produce a solution of ferrous sulfate and a beneficiated solids residue containing copper sulfides and residual iron with concurrent evolution of H.sub.2 S gas, said beneficiating solids residue being amenable to recovery of copper, separating the ferrous sulfate solution to an iron removal step, passing the SO.sub.2 from the oxidizing zone to an acid plant for production of sulfuric acid for use in the acid leach, and combining H.sub.2 S in gases from the reducing zone not fed to the oxidizing zone with H.sub.2 S from the acid leach for production and recovery of elemental sulfur.

US-PAT-NO: 5354345

DOCUMENT-IDENTIFIER: US 5354345 A
See image for Certificate of Correction

TITLE: Reactor arrangement for use in beneficiating carbonaceous solids; and process

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Brief Summary Text - BSTX (28):

A process and apparatus for the thermochemical beneficiation of carbonaceous solids is described by P. B. Tarman et al. in U.S. Pat. No. 4,579,562, the disclosure of which is incorporated herein by reference. This system uses a pressurized countercurrent extraction reactor. The process introduces carbonaceous solids, between about 1/4 inch (6 mm) to 4 inches (10 cm) in diameter, and substantially free of surface liquids into the upper portion of the reactor. These solids move in a countercurrent flow to a process liquid that flushes the product liquid containing dissolved and suspended organic material, which is released from the carbonaceous solids. The beneficiated solids are then removed from the lower portion of the reactor. The product liquid is removed from the upper portion of the reactor and is directed to a water treatment facility.

Brief Summary Text - BSTX (40):

Several embodiments of this conveying means or solids discharge arrangement are described in detail. For example, the conveying means may include at least one screw conveyor. The screw conveyor(s) may be sufficiently long and narrow in cross section to allow direct discharge of the carbonaceous solids to ambient pressure. The conveying means may also include a hollow-shafted auger(s) for providing advantageous discharge of the beneficiated solids. In a preferred embodiment, the screw conveyor(s) discharges the solids into a hydraulic lockhopper while under pressure. For added advantage a plurality of hydraulic lockhoppers are used for substantially continuous discharge.

Detailed Description Text - DETX (59):

If the nature of the solids feed is such that an additional impetus is necessary to initiate the falling of the wet feed solids 51 into the reactor vessel 20, due, for example, to the existence of a hydraulic lock present after the opening of the feed lockhopper outlet valve arrangement 129, a portion of the process gases from the process gas receiving region 96 in the upper countercurrent reactor region 48 may be charged into the feed hydraulic lockhopper 122 (along the direction of arrow 141) to force the material downward by pressure. The process gases are removed from the process gas receiving region 96 through a vent arrangement 142 (along the direction of arrow 143) and transported to the feed hydraulic lockhopper 122 through the gas flow outlet conduit 144 and the feed lockhopper gas conduit 146. (FIG. 5 indicates process gas is directed to only one lockhopper in order to simplify the diagram.) The process gases are preferably pressurized to a pressure slightly greater, i.e., about 50-70 psi, than that in the upper countercurrent reactor region 48, by the gas compressor arrangement 148. As will be seen elsewhere in this description, it may also be desirable to compress a portion of the process gases extracted from the upper countercurrent reactor region 48 for use in discharging the beneficiated solids.

Detailed Description Text - DETX (63):

A certain volume of the process liquid 24, preferably water, containing water removed from the beneficiated materials, may also need to be removed from
the system at various times throughout the beneficiation process. This is because the water removed from the beneficiated solids adds to the total volume of the process liquid, and for effective thermodynamic processes to occur some of the liquid preferably is removed. Thus, at least a portion of the process liquid 24 may be directed to a water treatment system 158 along the direction of arrow 159. Again, it may also be directed to system 158 via overflow orifice 78 along the direction of arrow 160.

Detailed Description Text - DETX (70):

The process liquid 24 that is recycled back into the reactor vessel 20 through the fluid flow inlet arrangement 60 is preferably in an amount and rate that is just sufficient to provide the desired temperature of the wet processed solids before they are discharged from the reactor vessel 20. That is, a sufficient amount of the recirculated process liquid 24 is introduced into the reactor vessel 20 such that the process liquid 24 cools the beneficiated solids to a desired temperature level before removal. In certain circumstances, such as operation under nonequilibrium conditions, it may be advantageous to provide a means for further cooling the recirculated water, such as by a heat exchanger

170. Generally, however, during stabilized operation, i.e., equilibrium operating conditions, the temperature of the process liquid 24 in the upper countercurrent reactor region 48 is sufficiently cool for recirculation directly back into the reactor vessel 20 through the fluid flow inlet arrangement 60. Furthermore, during stabilized operation, the solids have been retained in the reactor for a sufficient length of time for the heat exchange process to cool the solids to the desired exit temperature.

Detailed Description Text - DETX (77):

One embodiment including means for discharging solids with the above-listed advantages is the solids discharge system 200 shown in FIG. 6. For FIG. 6, the reactor 20 may be as described above for FIG. 4, although there is no requirement that it be so. Screw conveyor 210, as shown in FIG. 6, comprises an auger 212 located within an enclosure 214, and inserted through a solids discharge opening 216 in the reactor internal side wall 25 within the lower portion 33 of the lower countercurrent reactor region 26. In a preferred embodiment, the screw conveyor 210 is angled upward with sufficient elevation to maintain the liquidus level 218 below an exit opening 220 of the auger enclosure 214. During operation, this positioning advantageously allows for a controlled, positive removal of the beneficiated carbonaceous solids 22 from the reactor vessel 20 while inhibiting extraneous flow of the process liquid 24 with the solids 22. That is, the beneficiated solids are positively removed and not just allowed to pass out of the reactor under the influence of gravity alone. In this embodiment, the screw conveyor 210 simultaneously acts as a solids extractor and dewatering screw. It will be understood that in some applications of the present invention, a plurality of screw conveyors 210 may be used to advantage.

Detailed Description Text - DETX (83):

The solids discharge system 200 provides a means for transferring the beneficiated carbonaceous solids 22 from the reactor vessel 20 into the lockhopper 240 in a controlled and generally nonplugging manner. In this embodiment, the process liquid 24 is generally separated from the beneficiated solids 22 being extracted from the reactor vessel 20. That is, generally only processed, i.e., beneficiated, solids are discharged from the reactor. This is not intended to mean, however, that there is no surface and/or residual process liquids associated with the removed solids, nor does it mean that the solids are thoroughly beneficiated. Also, in this embodiment the product lockhopper 240 may either operate with the wet beneficiated solids product alone, or it may operate as a hydraulic lockhopper filled with the process liquid 24, a portion of which is extracted from the upper countercurrent reactor region 46 and directed to the lockhopper 240. The use of extracted upper reactor process

liquid to fill the product lockhoppers provides a thermodynamic advantage because use of extraction liquid in lieu of reactor bottom process liquid keeps the process liquid flowing in the right direction, i.e., upwardly in the reactor.

Detailed Description Text - DETX (84):

The solids discharge system 200 allows for positive extraction of the beneficiated solids with reduced likelihood of plugging, generally without removal of relatively large amounts of processing liquids, and generally without vigorously stirring the packed bed of solids.

Detailed Description Text - DETX (89):

Another embodiment of means for discharging solids is the solids discharge system 400, is shown in FIG. 8. For FIG. 8, the reactor 20 may be as described above for FIG. 4, although there is no requirement that it be so. Referring to FIG. 8 beneficiated solids from the densely packed submerged solids 84 can be continuously extracted from the lower portion 33 of the lower countercurrent reactor region 26 with the use of a hollow core screw conveyor arrangement 410. In some applications, a plurality of screw conveyor arrangements 410 may be used. This embodiment generally eliminates the flow of the process liquid 24 from the reactor vessel 20. This is particularly advantageous to the overall thermodynamics of the thermochemical beneficiation process for reasons we have
discussed above. In addition, process liquid that has been extracted from the upper countercurrent reactor region is recirculated in a novel and efficient way from the fill liquid used to charge product lockhopper. This practice is also advantageous to the overall thermodynamics of the process.

Detailed Description Text - DETX (92):

The auger 412 needs to be of a length that is sufficient to extract the beneficiated solids from the reactor vessel 20 and convey the mixture of solids and liquids to a convenient location for the product lockhopper 440. The solids 22 and a portion of the process liquid 24, upon approach of the second end 436 of the completely enclosed screw conveyor 410, are discharged through the exit opening 420. This discharging is aided by forces from a combination of gravity and flush liquid (from the line 441). The solids/liquids are discharged into the product lockhopper 440, preferably into an arrangement of a plurality of the product lockhoppers 440 with a toggling tripper 442 to direct the flow of the material. This method is superior to simple gravity settling, in that it provides a convective conveyance of the solid particles downward towards the product lockhopper 440, which greatly accelerates the throughput.

Claims Text - CLTX (36):
(a) means for selectively and continuously discharging beneficiated solids from the reactor vessel and through the solids discharge opening in the reactor vessel outer sidewall.

Claims Text - CLTX (37):
9. An apparatus system according to claim 8 wherein said means for selectively and continuously discharging beneficiated solids comprises at least one screw conveyor.

US-PAT-NO: 5853590

DOCUMENT-IDENTIFIER: US 5853590 A

TITLE: Method for treating bioorganic and wastewater sludges

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Brief Summary Text - BSTX (46):

Among the objectives of the present inventions are to provide a method of treating and stabilizing bioorganic or organic sludges and/or wastewater sludges in such a processing sequence as to carefully regulate the pathogen control mechanisms incorporated while minimizing the heat and ammonia stresses to the indigenous surviving microflora in order to provide a beneficiated soil or fertilizer.